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ABSTRACT

Because knowledge is constantly in flux, it is important for individuals to accurately incorporate new information into previously developed knowledge structures. Some of the issues surrounding this development of thought are explored in this paper. Although the phenomenon of knowledge integration is relatively common, very little empirical research has been devoted to the topic. The general objective of this study is to examine some of the components involved in the integration of knowledge. Participants for the study were 68 students recruited from undergraduate psychology courses. The students initially learned a body of material formatted as either a knowledge map or as a standard text. After studying this initial information, they were presented with new information that either supported or contradicted what they had previously learned (without having the original materials available). The results indicate that knowledge maps are more effective than text for facilitating the integration of knowledge. (MKA)

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# Integrating New Information Into Prior Knowledge

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## Abstract

Although the phenomenon of knowledge integration is relatively common, very little empirical research has been devoted to this topic. The general objective of the current study was to examine some of the components involved in this process. Participants initially learned a body of material formatted as either a knowledge map or standard text. After studying the initial information, participants were presented with new information that either supported or contradicted what they had previously learned (without having the original materials available). Results indicated that knowledge maps were more effective than text for facilitating the integration of knowledge.

## Integrating New Information Into Prior Knowledge

Because knowledge is constantly in flux, it is important for individuals to accurately incorporate new information into previously developed knowledge structures. Prior research on this process has been primarily limited to the revision of word lists (e.g., Bjork, 1978; Tulving, 1966), although there have been a few exceptions (see Wilkes & Leatherbarrow, 1988). One important finding from these studies was that integrating knowledge (or updating), in some cases, is more difficult than learning new information (Tulving, 1966). Although prior research has suggested principles involved in the integration process (cf. Anderson, 1981), its relevance for larger and more complex bodies of information appear to be limited.

The present study extends this research by examining the effect of different original information formats on the recall of subsequently incorporated information. Two presentation formats were utilized in the current study. The first, knowledge map (see Figure 1), is a semantic node-link display that represents key concepts and ideas (nodes) and the relationships (links) these concepts share (Evans & Dansereau, 1991; Lambiotte, Dansereau, Cross, & Reynolds, 1989). The second format was informationally-isomorphic text. A second factor that may have a major impact on the integration process is the type of information that is being integrated into an existing knowledge structure (Larsen, 1982), or more specifically, the relationship between the new and old information. If new information has enough relevance to warrant its integration into existing knowledge, then the new information must somehow support or contradict existing knowledge structures. Supportive information is information that

substantiates, confirms, or elaborates existing knowledge. In contrast, contradictory information is information that replaces or corrects existing knowledge. The impact of these two types of information on integration was examined.

## METHOD

### *Participants*

Sixty-eight students recruited from undergraduate psychology courses received experimental credit for their participation.

### *Materials*

A knowledge map was constructed containing information on the life and scientific contributions of Albert Einstein (60 nodes/59 links). An informationally isomorphic text (538 words) was also constructed. Participants were also given an update list containing nine sentences that supported the original information and nine contradictory sentences.

### *Procedure*

All participants were trained on how to read and utilize knowledge maps. Next, participants were randomly assigned to one of two experimental groups. They were given 15 minutes to read and study the Einstein map or text. Immediately after studying participants completed a free recall test and the Delta Reading Vocabulary Test (Deignan, 1973). Participants were then given a list of 18 sentences and told to implicitly incorporate this information into what they had previously studied (the original materials were not available). Forty-eight hours later participants completed another free recall test.

## RESULTS

A t-test was conducted on the first of the two free recall tests in order to determine any differences between the map and text groups that may have been attributed to initial learning. The means for the map and text groups were 114.64 and 108.89 respectively; they were not significantly different ($t<1$).

A one-way MANCOVA was conducted on the second free recall test with unupdated, supportive-new, and contradictory-new information serving as the dependent variables and with the Delta serving as the covariate. Means and standard deviations are presented in Table 1. There was a significant multivariate effect, $F(3, 63) = 6.57$, $p < .05$. There were significant univariate effects for all three types of information, [unupdated information, $F(1,65) = 16.47$, $p < .05$; supportive information, $F(1,65) = 5.26$, $p < .05$; and contradictory, $F(1,65) = 4.05$, $p < .05$] indicating participants who studied maps outperformed those using text.

## DISCUSSION

The fact that knowledge maps enhanced delayed recall for the unupdated information was not surprising, considering prior research showing the superiority of maps (i.e., Holley & Dansereau, 1984). The fact that recall for the unupdated information was better after 48 hours when retrieval conditions would be more difficult, suggests that maps enhance retrievability of the information rather than initial encoding (see Lambiotte et al., 1989).

However, the more important question is, "why did participants utilizing maps outperform those utilizing text for the new information when the presentation format was

the same for both groups (i.e., list of sentences)?" One possible explanation is that by studying maps initially, participants may have been able to integrate the new information more effectively than those who studied text. A second possibility is that both groups integrated the information equally, but access to important parts of the information were lost over time for those working with text. In any case, the current investigation suggests that knowledge maps are effective tools for facilitating the integration of knowledge.

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Table 1

Observed and Adjusted (Delta) Means and

Observed Standard Deviations for Free Recall 2 Measures

| Group and Information Type | Observed Mean | Standard Deviation | Adjusted Mean |
|---|---|---|---|
| Map | | | |
| Unupdated | 76.39 | 30.92 | 76.34 |
| Supportive | 8.92 | 5.85 | 8.91 |
| Contradictory | 13.31 | 7.05 | 13.30 |
| Text | | | |
| Unupdated | 52.78 | 27.61 | 52.83 |
| Supportive | 6.03 | 4.93 | 6.04 |
| Contradictory | 10.25 | 6.21 | 10.25 |

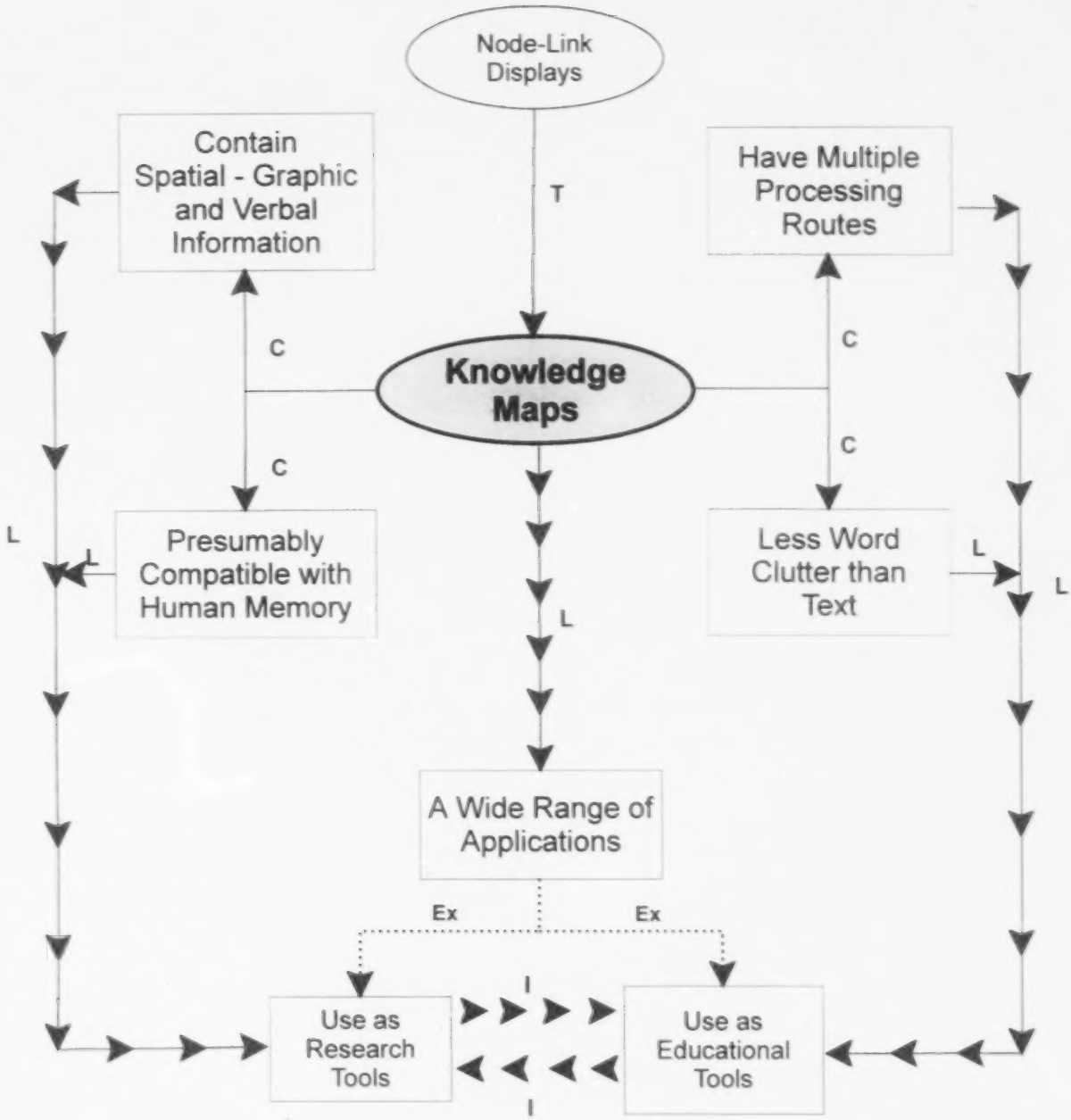


Figure 1. An example of a knowledge map.